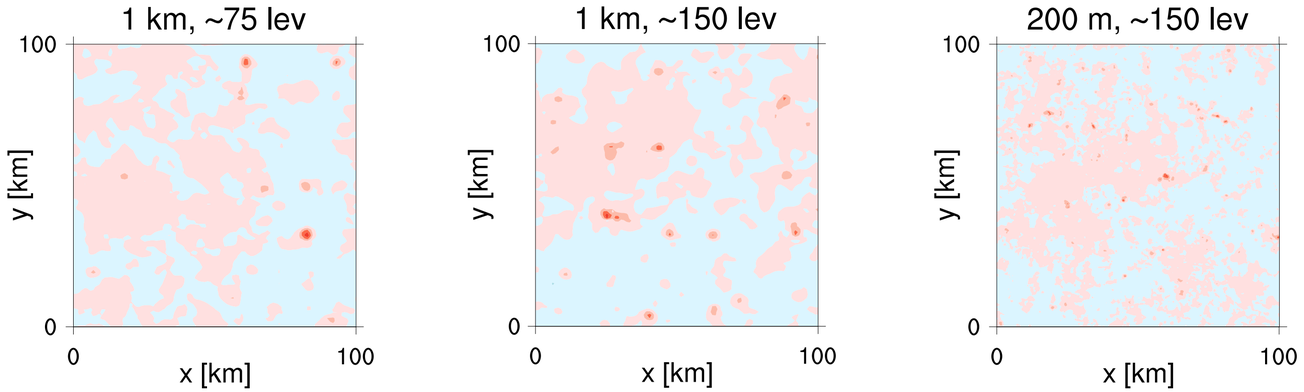
Climate sensitivity across the RCEMIP simulations

Tobias Becker

Max Planck Institute for Meteorology

RCEMIP provides a wide spectrum of models of different complexity

CRM & LES
(small domain)



CRM
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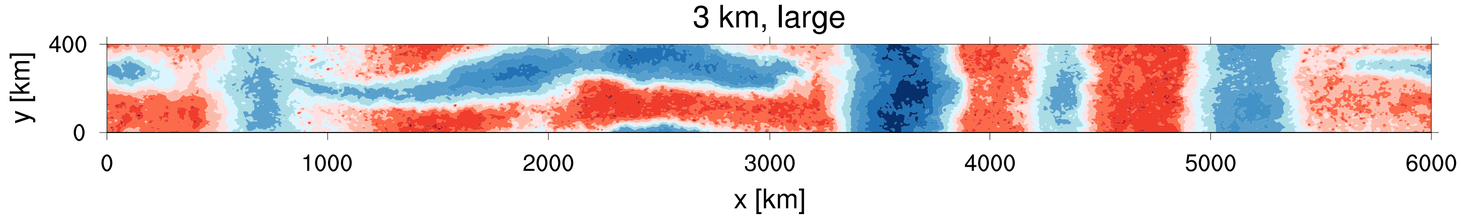
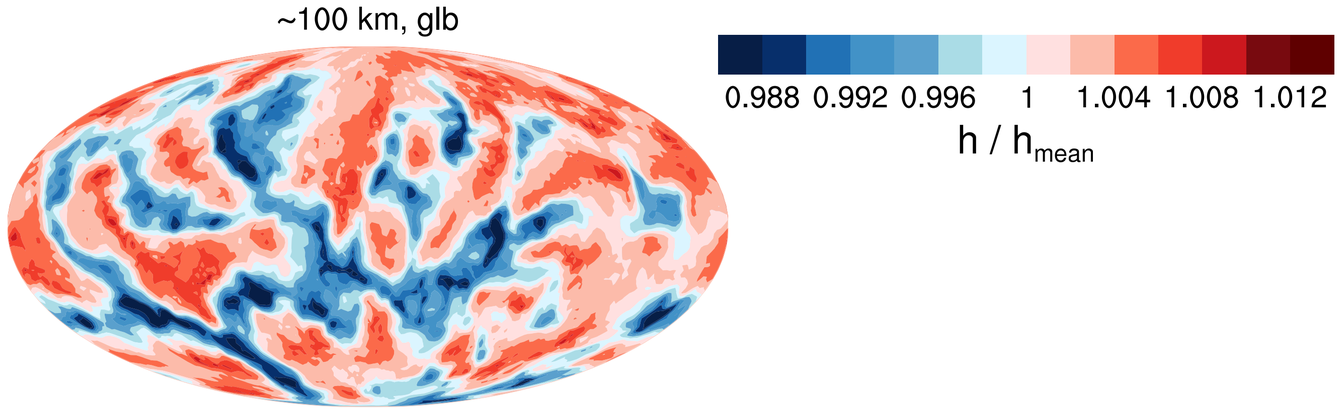


GCM



- simulation length:
  - 1000 days (GCM)
  - 100 days (CRM)
  - 50 days (LES)
- three prescribed SSTs: 295 K, 300 K, 305 K
- details on RCE setup in Wing et al., 2018

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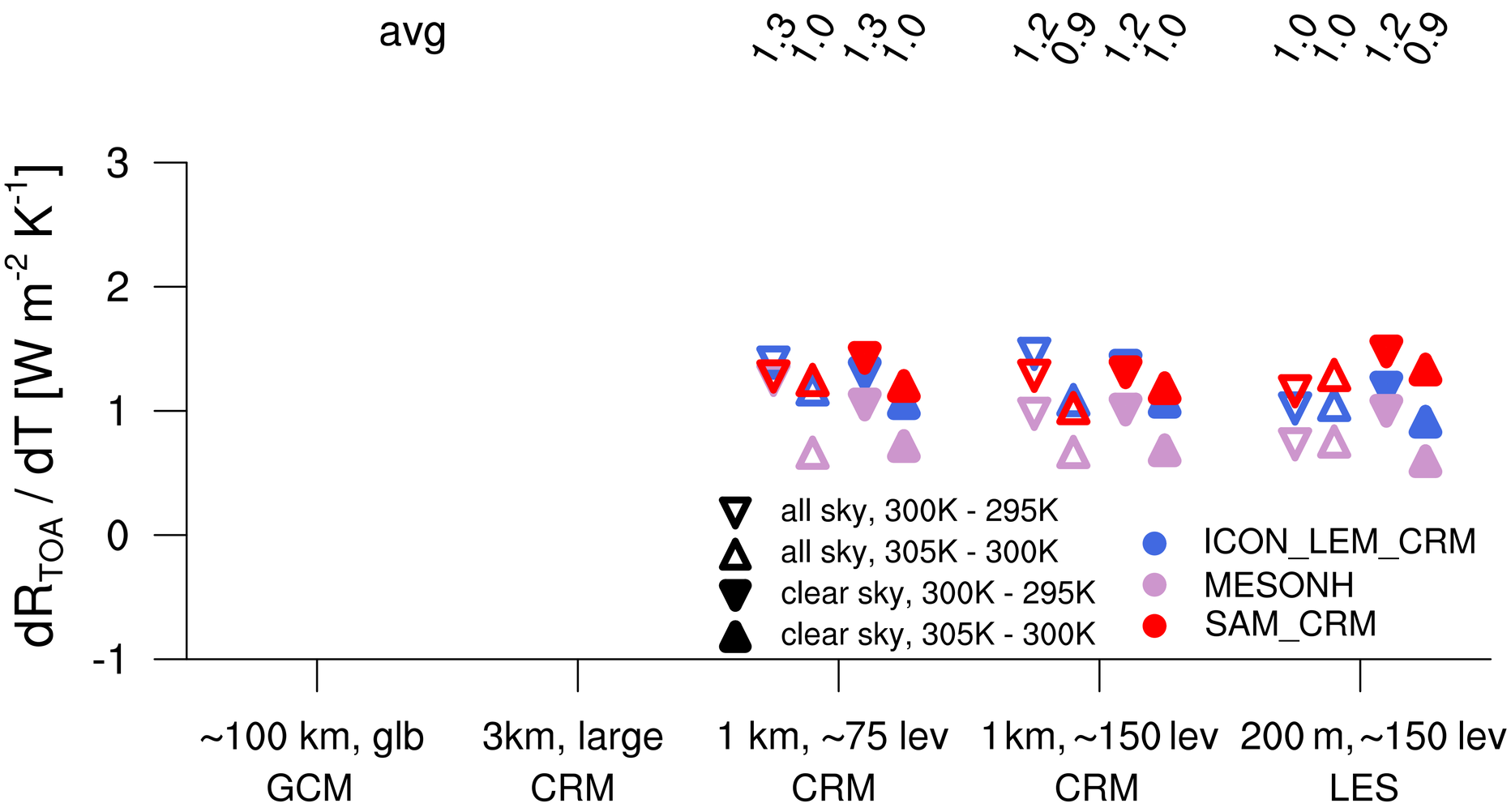
two ECS estimates per model: 305 K - 300 K & 300 K - 295 K
(skipping the first 50 days for GCM / CRM, and the first 25 days for LES)

Climate sensitivity across different RCEMIP model setups



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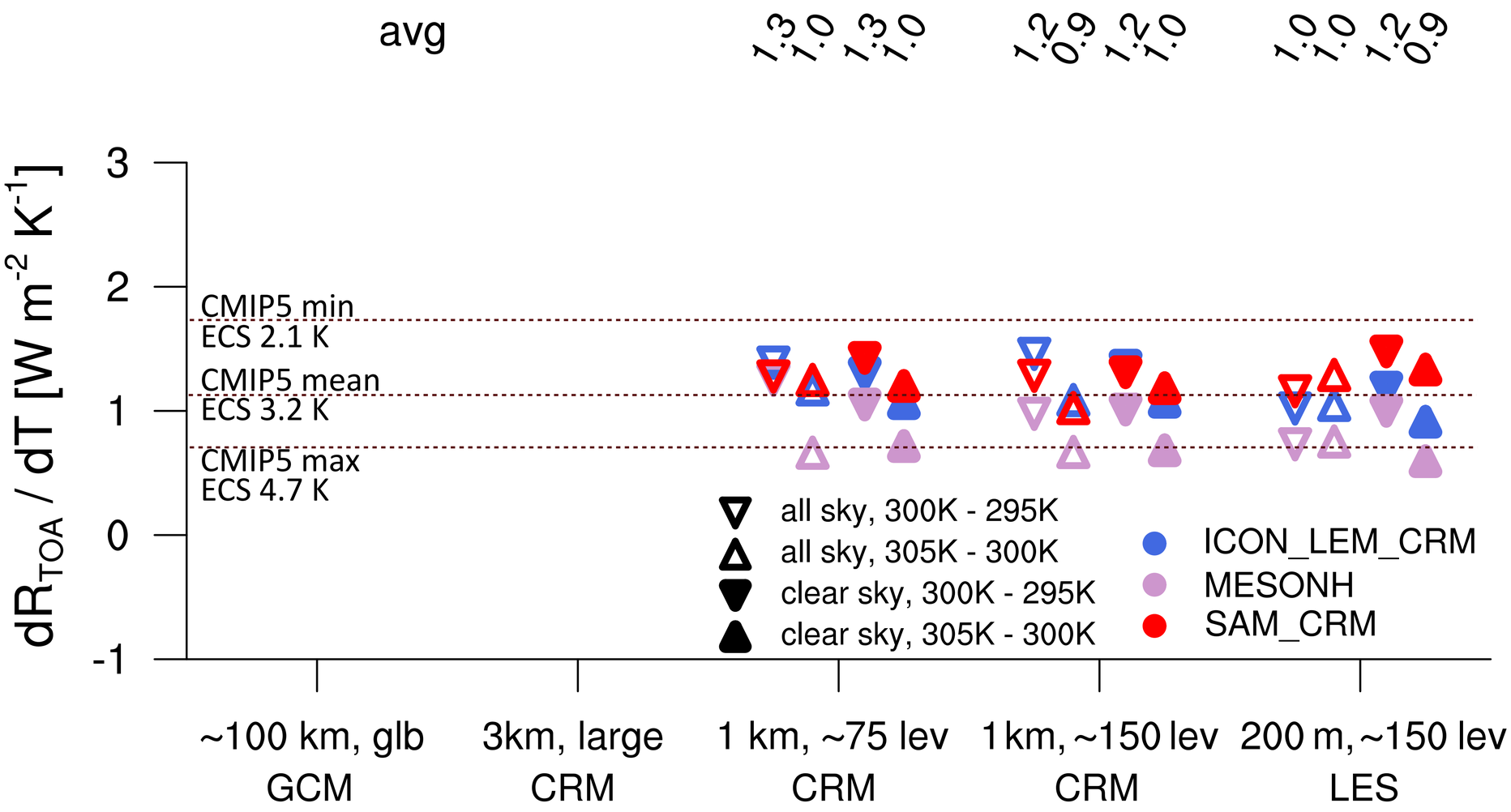

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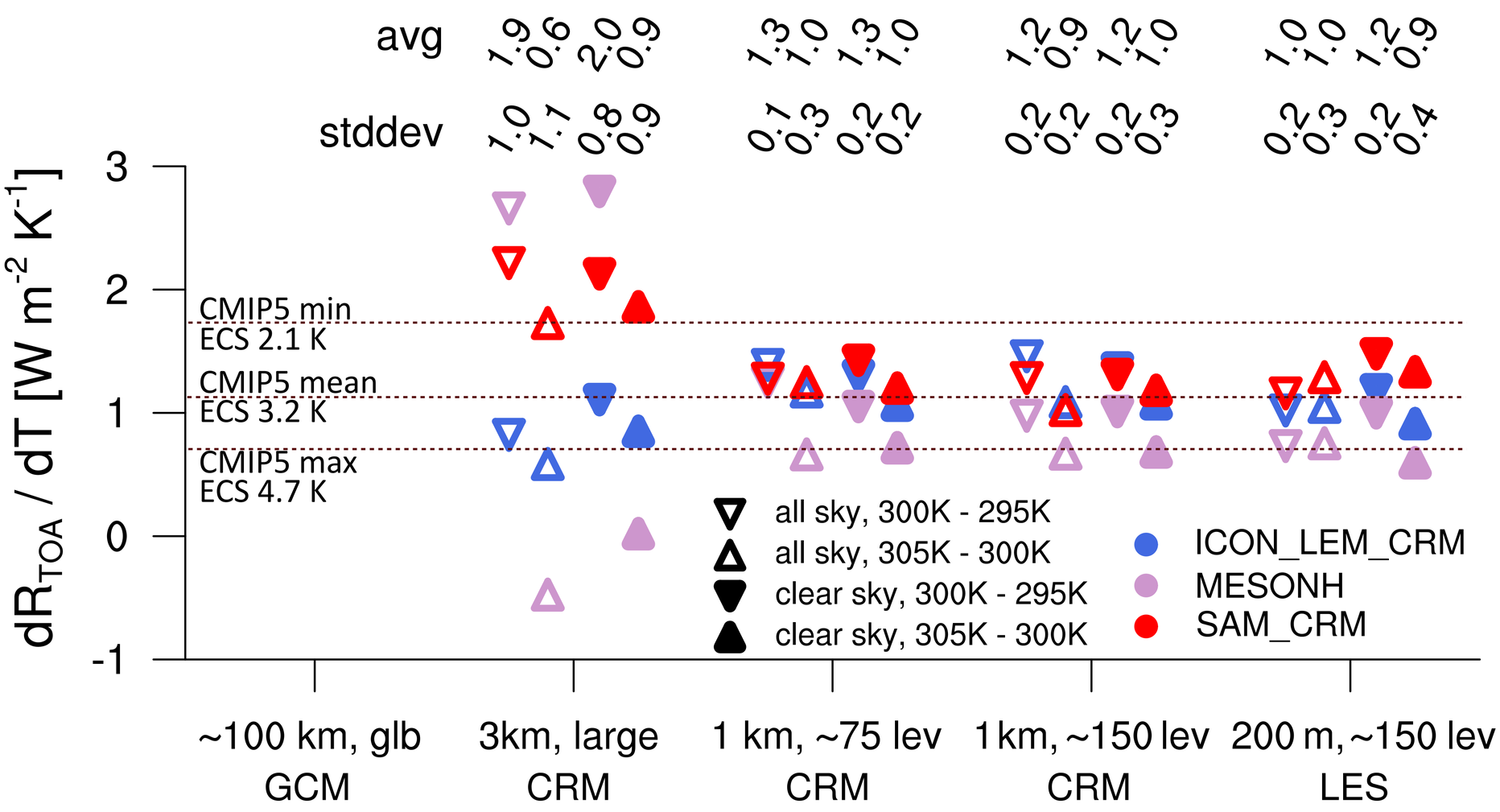

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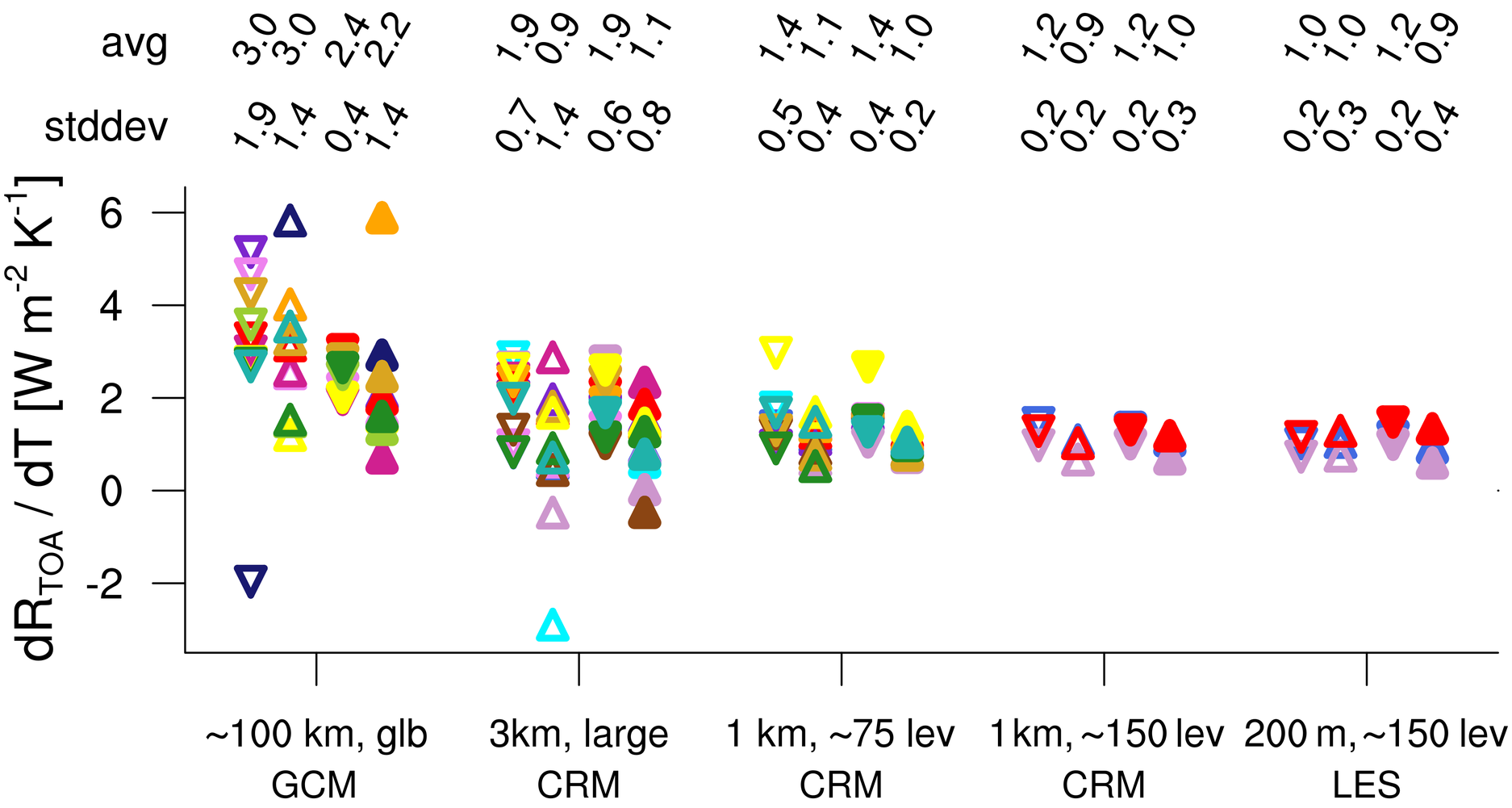

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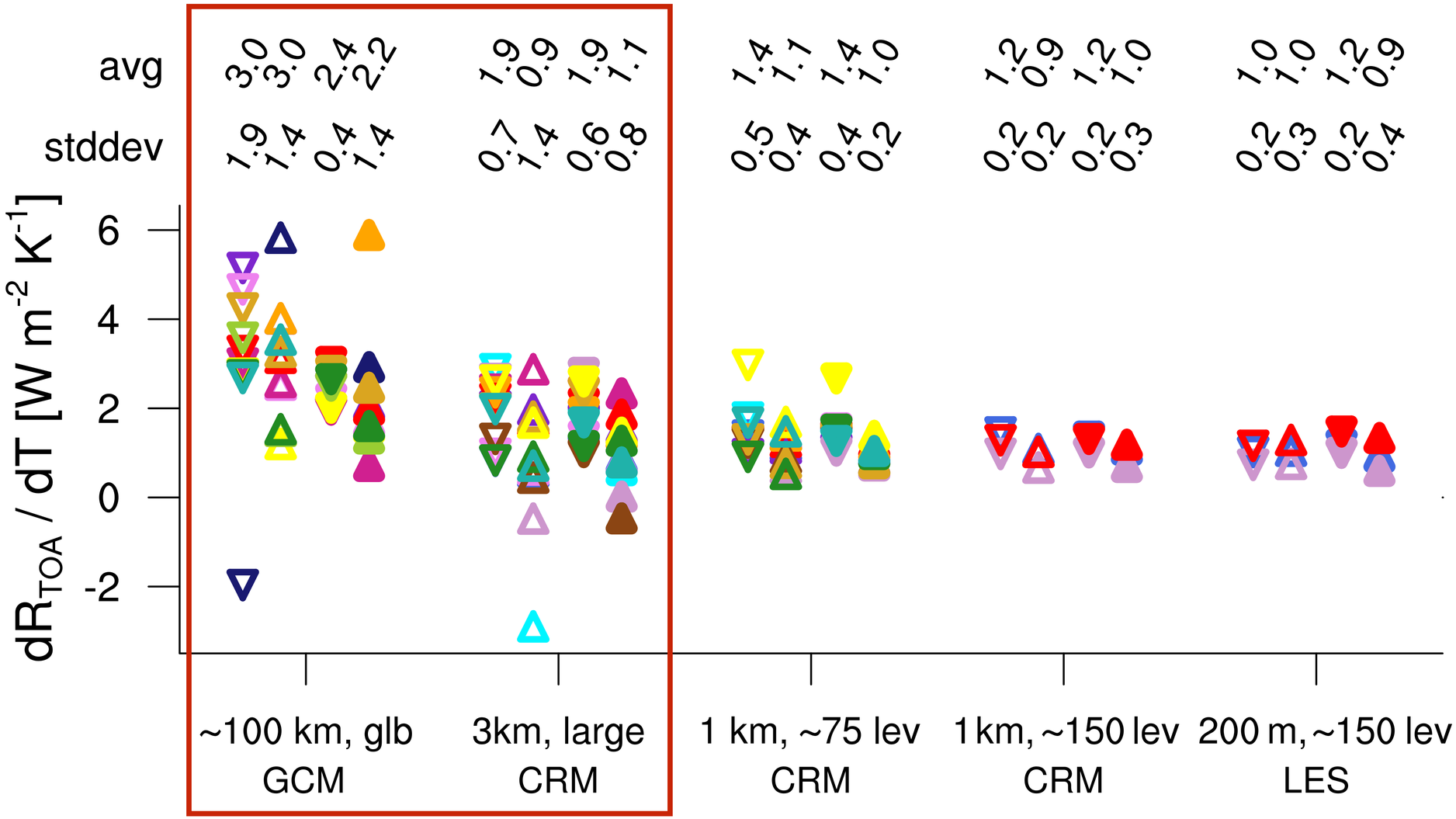

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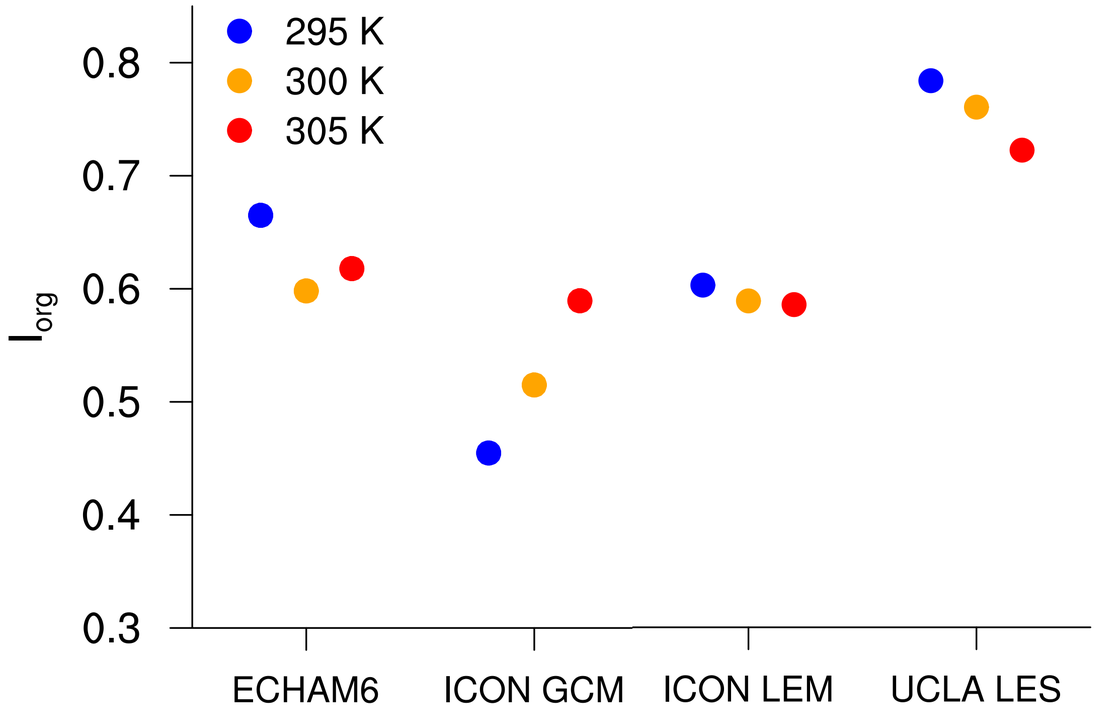
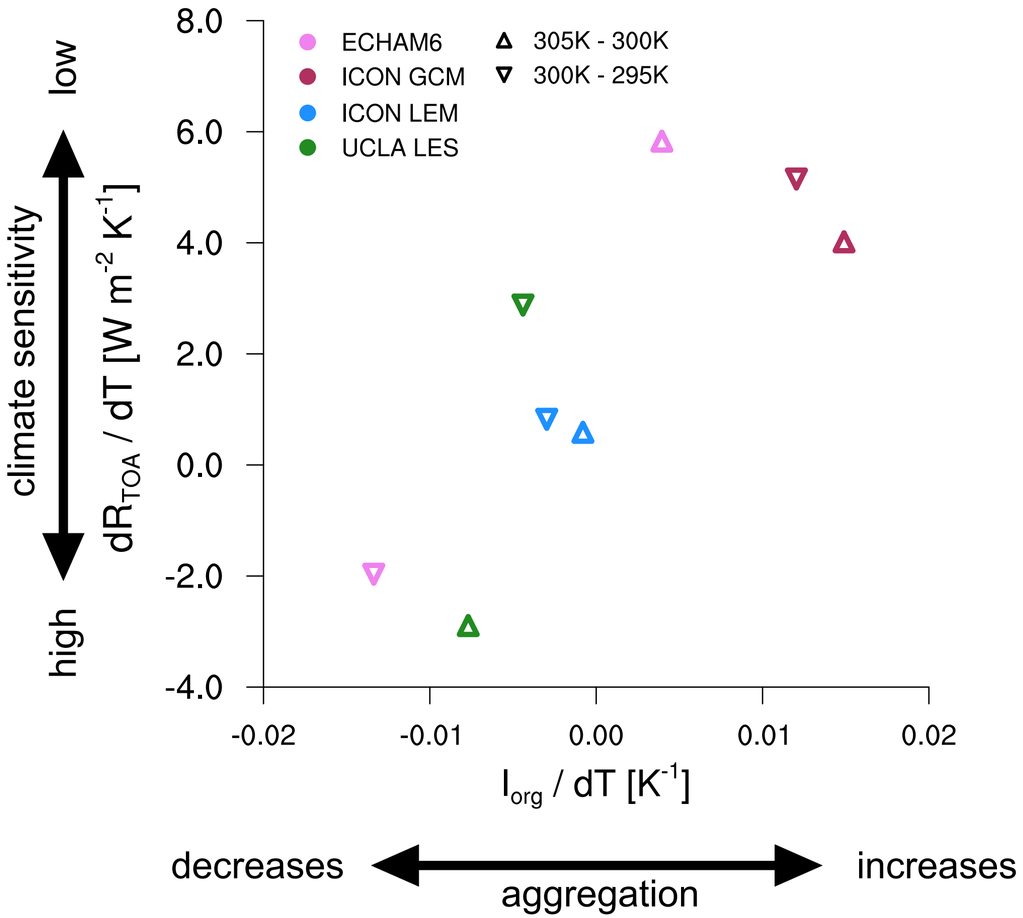
UCP Berlin 02/2019

MPI large domain models: extreme spread in climate sensitivity related to temperature dependence of convective self-aggregation



credits: Hauke Schulz; Tompkins and Semie, 2017



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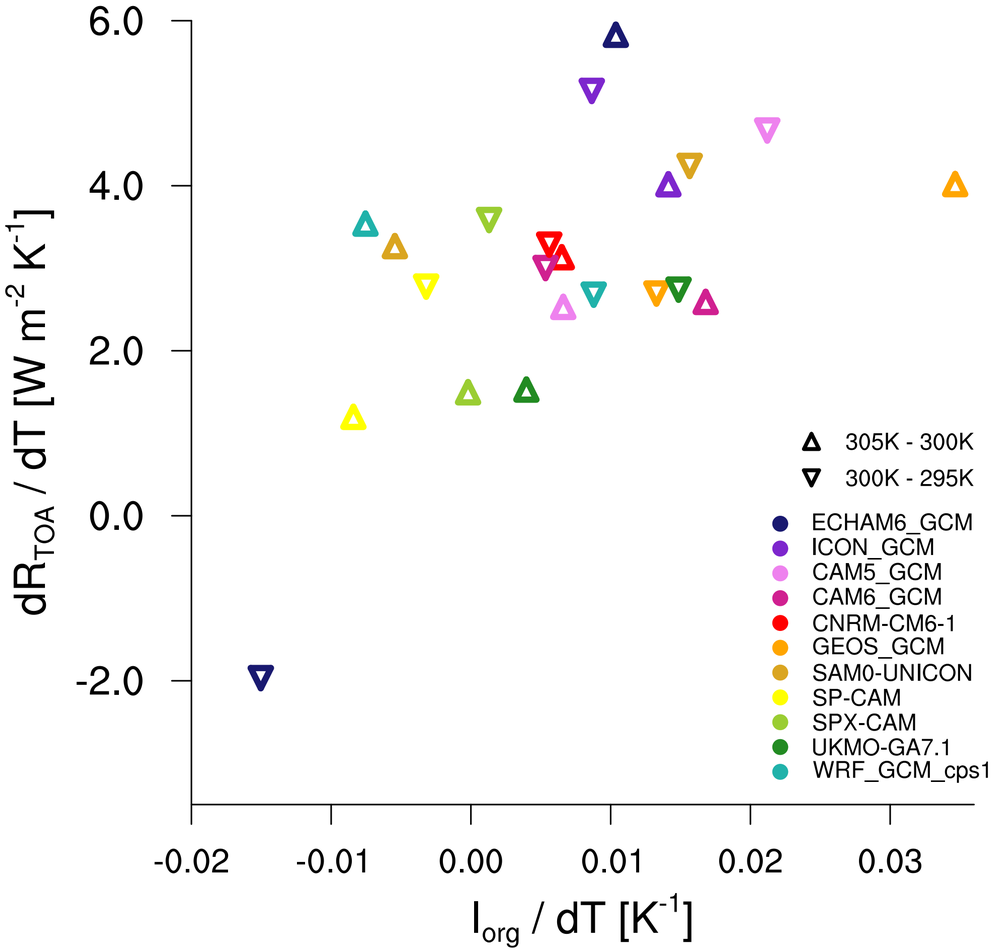

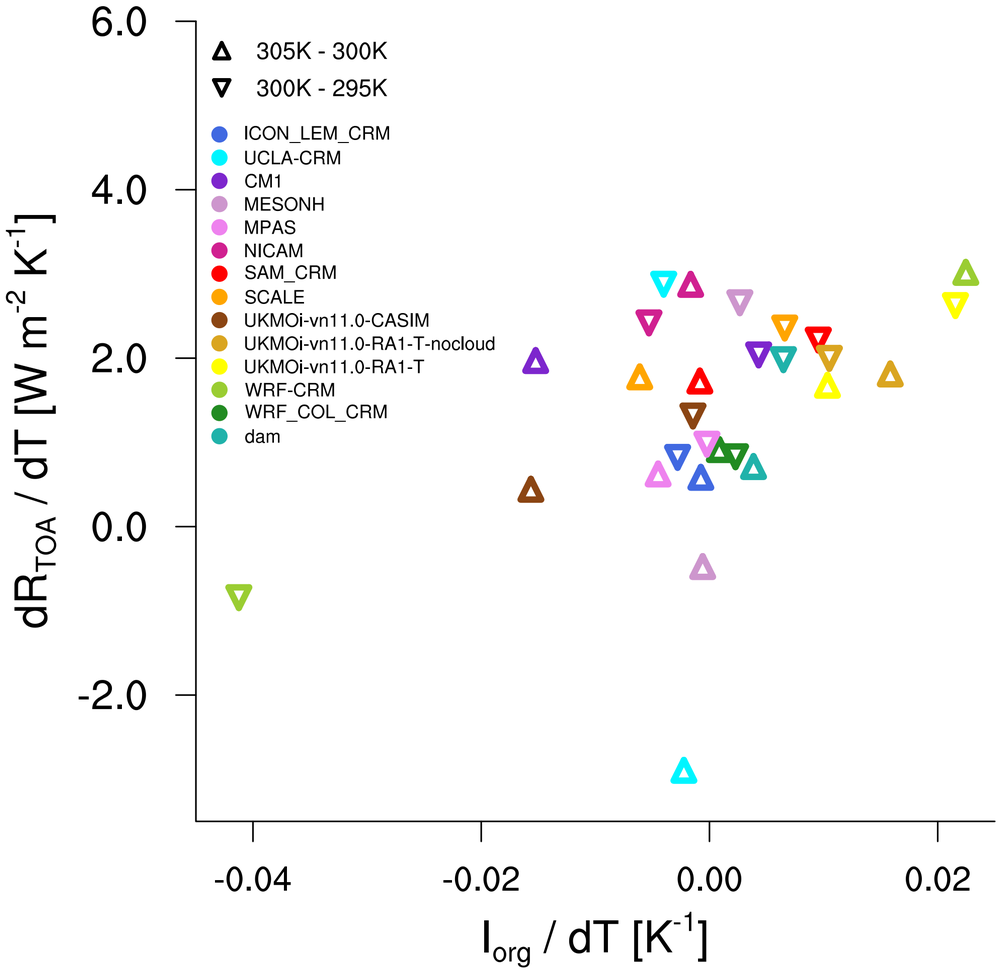

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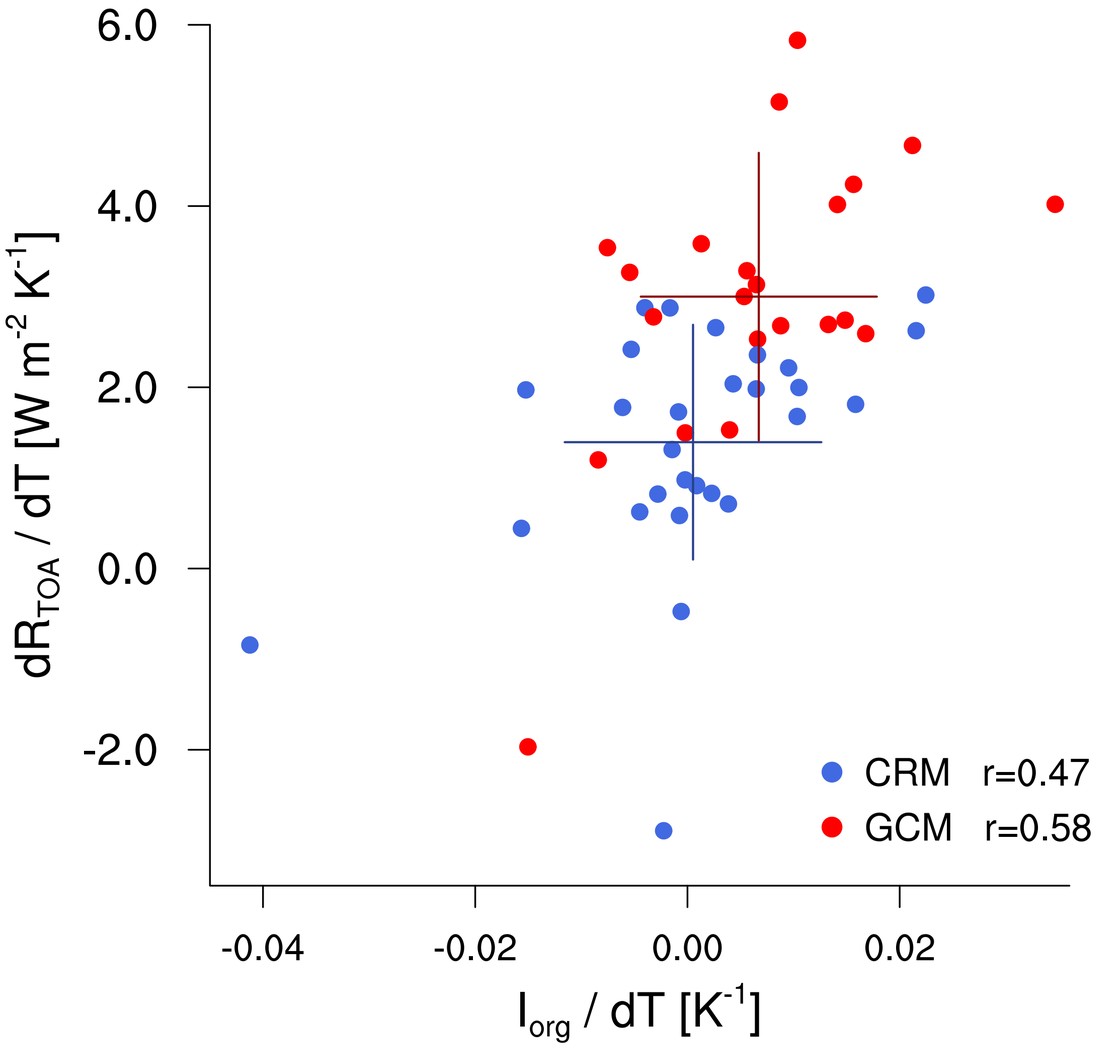

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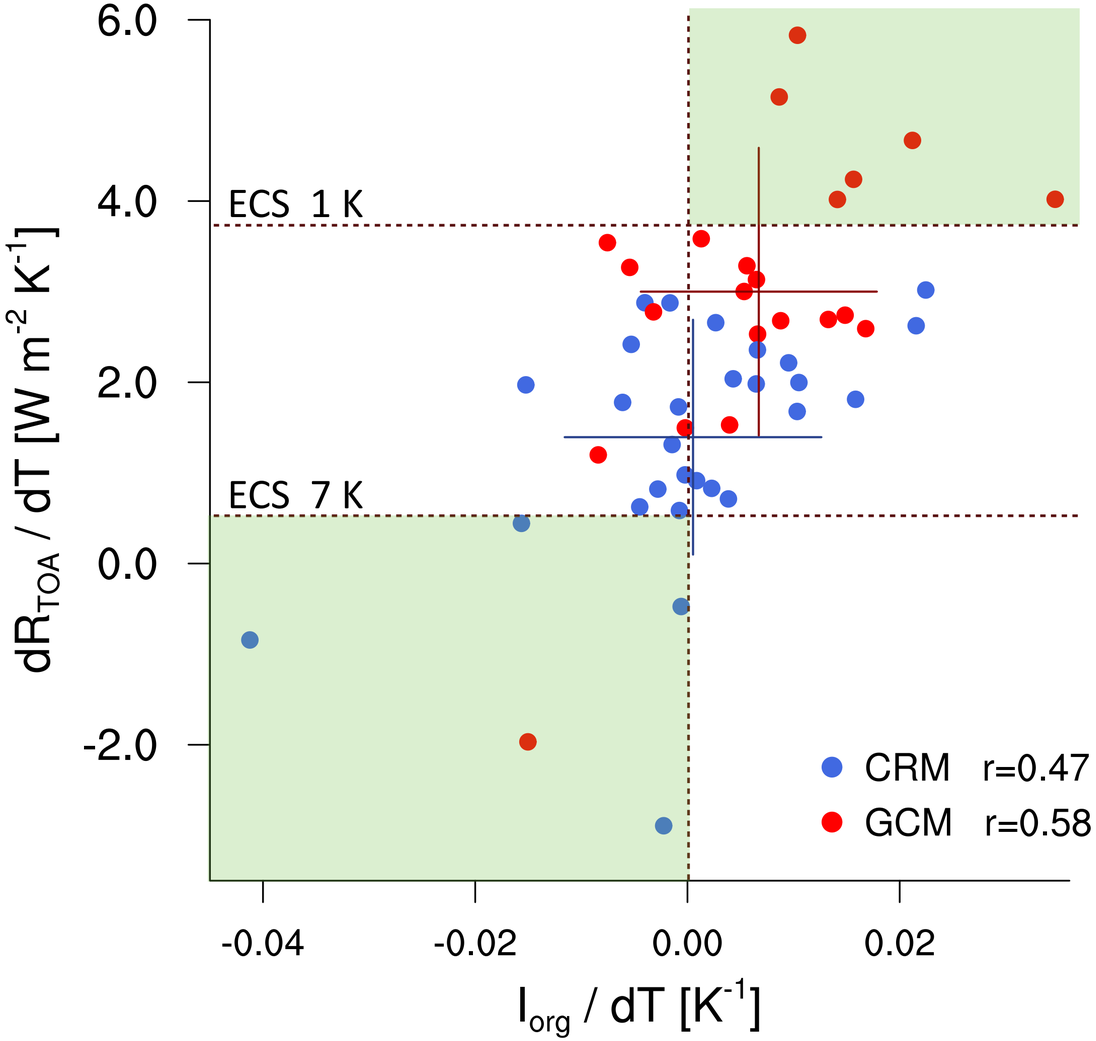

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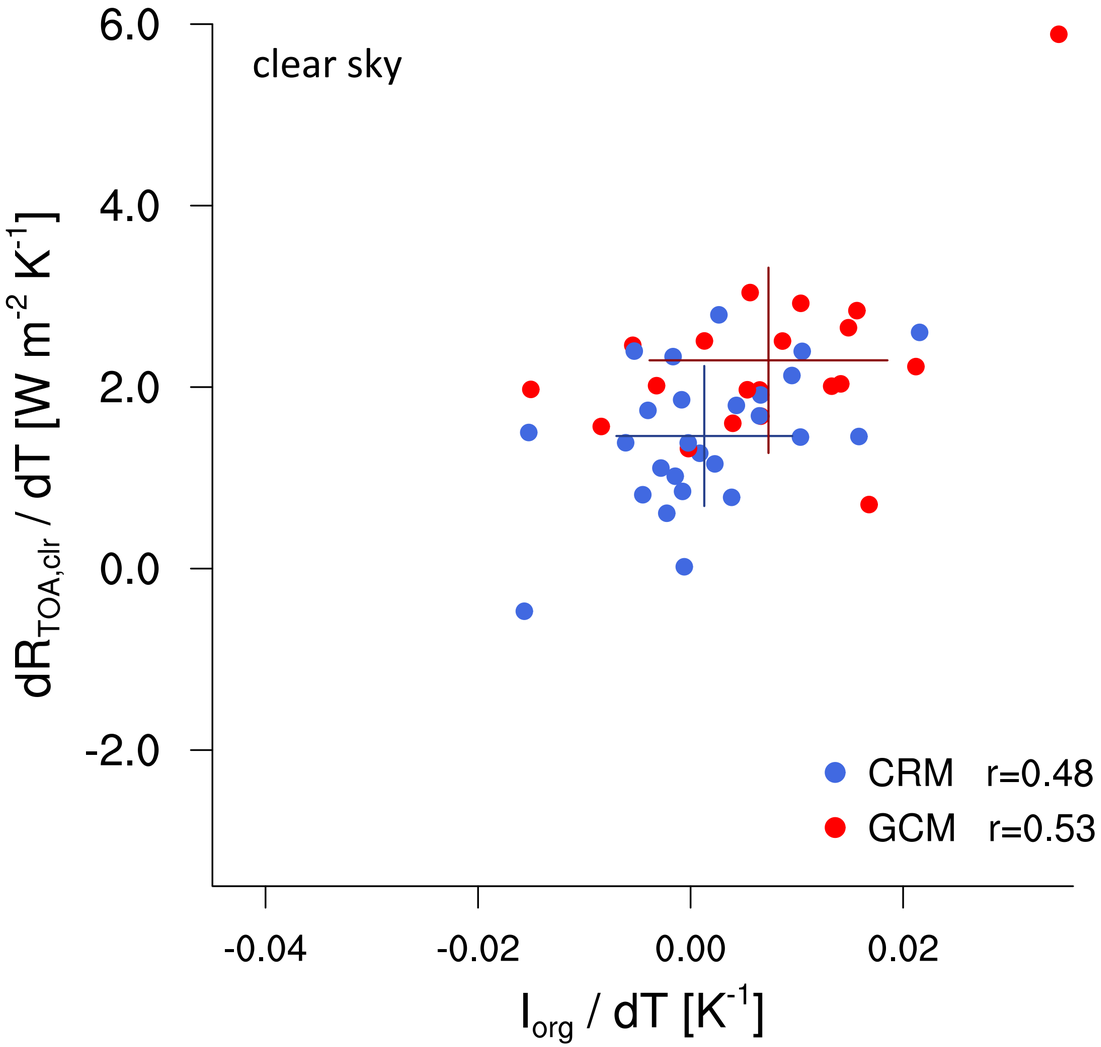

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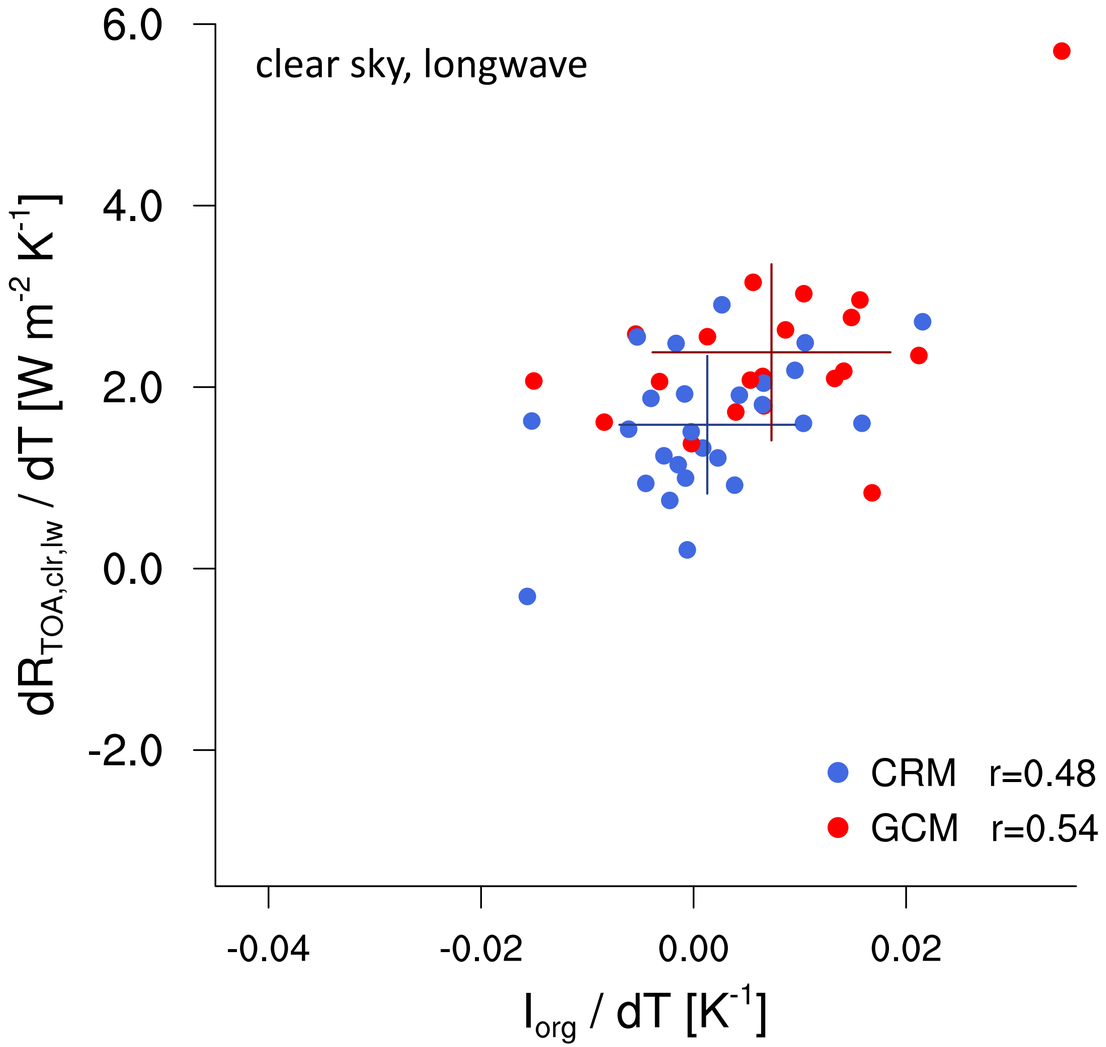

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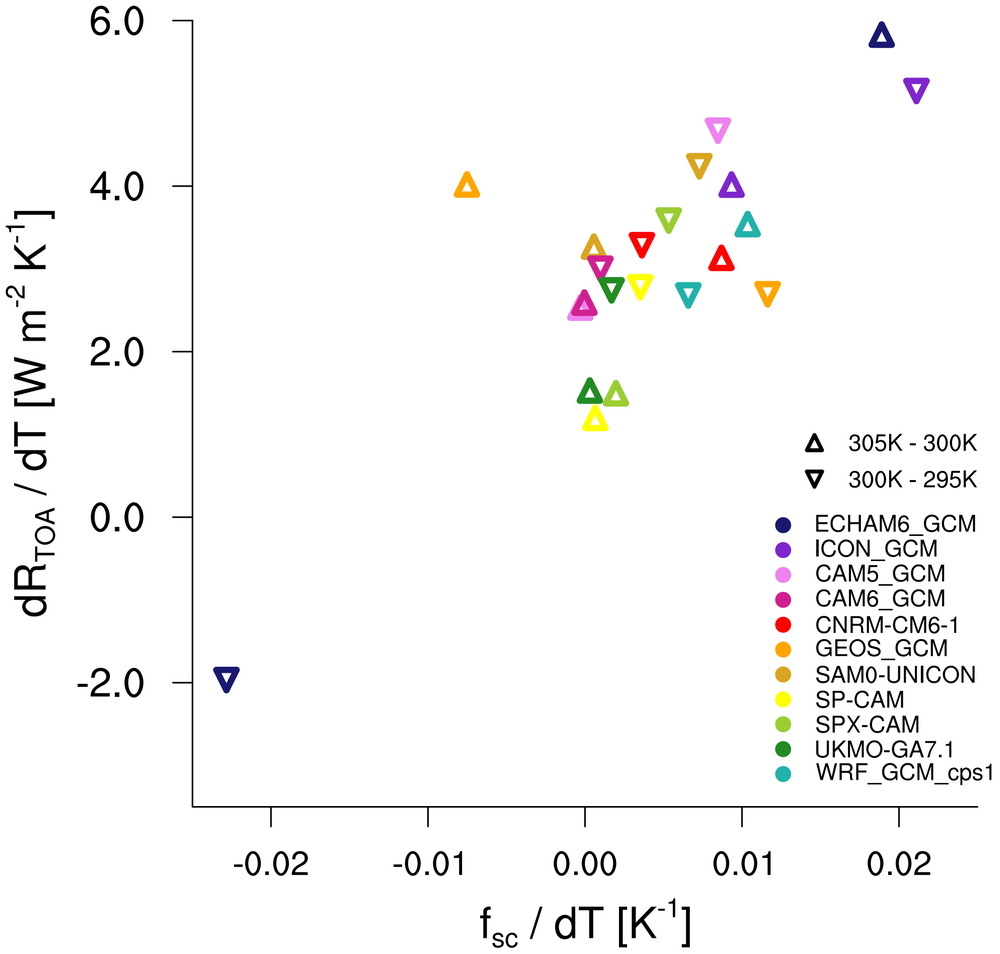
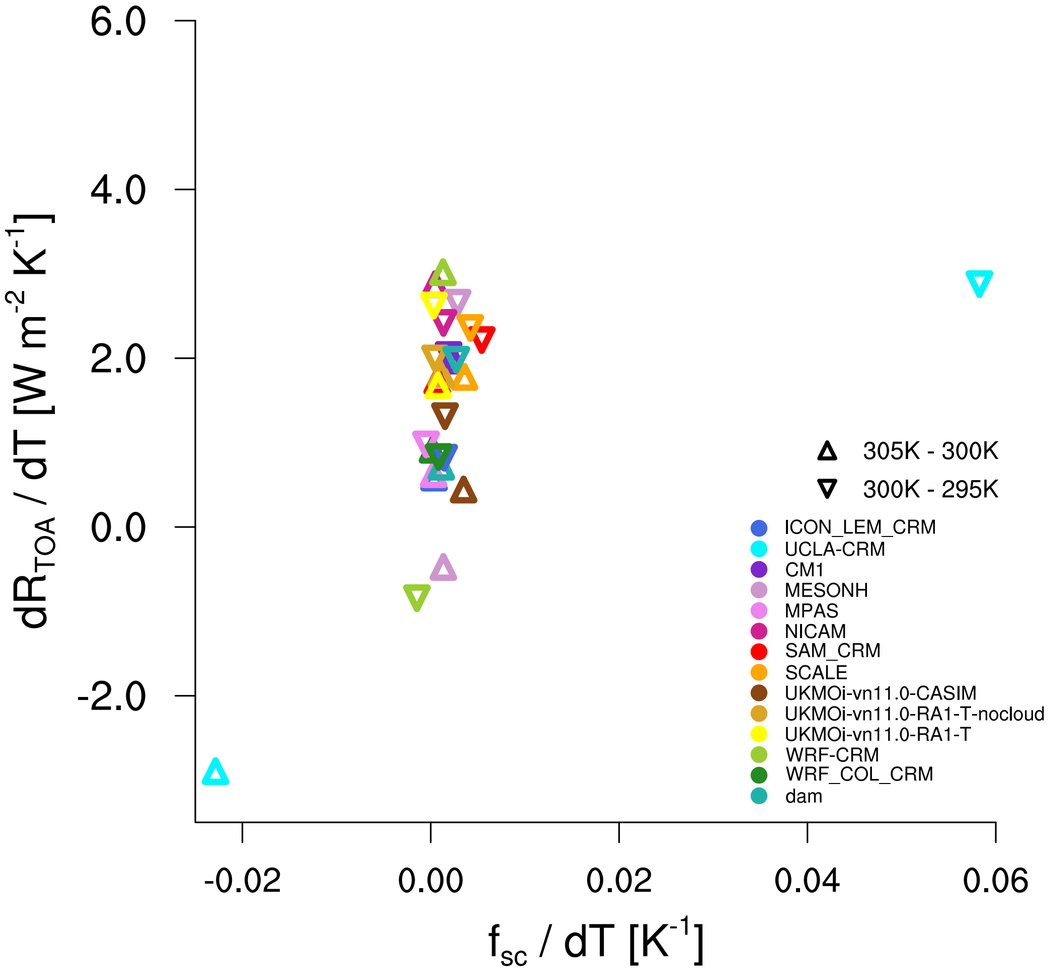
- changes in the clear-sky radiation budget only depend on longwave radiation
  ➔ mechanism: convective self-aggregation leads to a stronger overturning circulation, stronger drying in the subsidence regions and increased outgoing longwave radiation

GCMs and one CRM (UCLA-LES) also show a strong dependency on shallow cloud fraction in the subsidence regime ($R_{TOA,lw}$ > 250 W m^{-2}; $R_{TOA,sw,up}$ > 100 W m^{-2})





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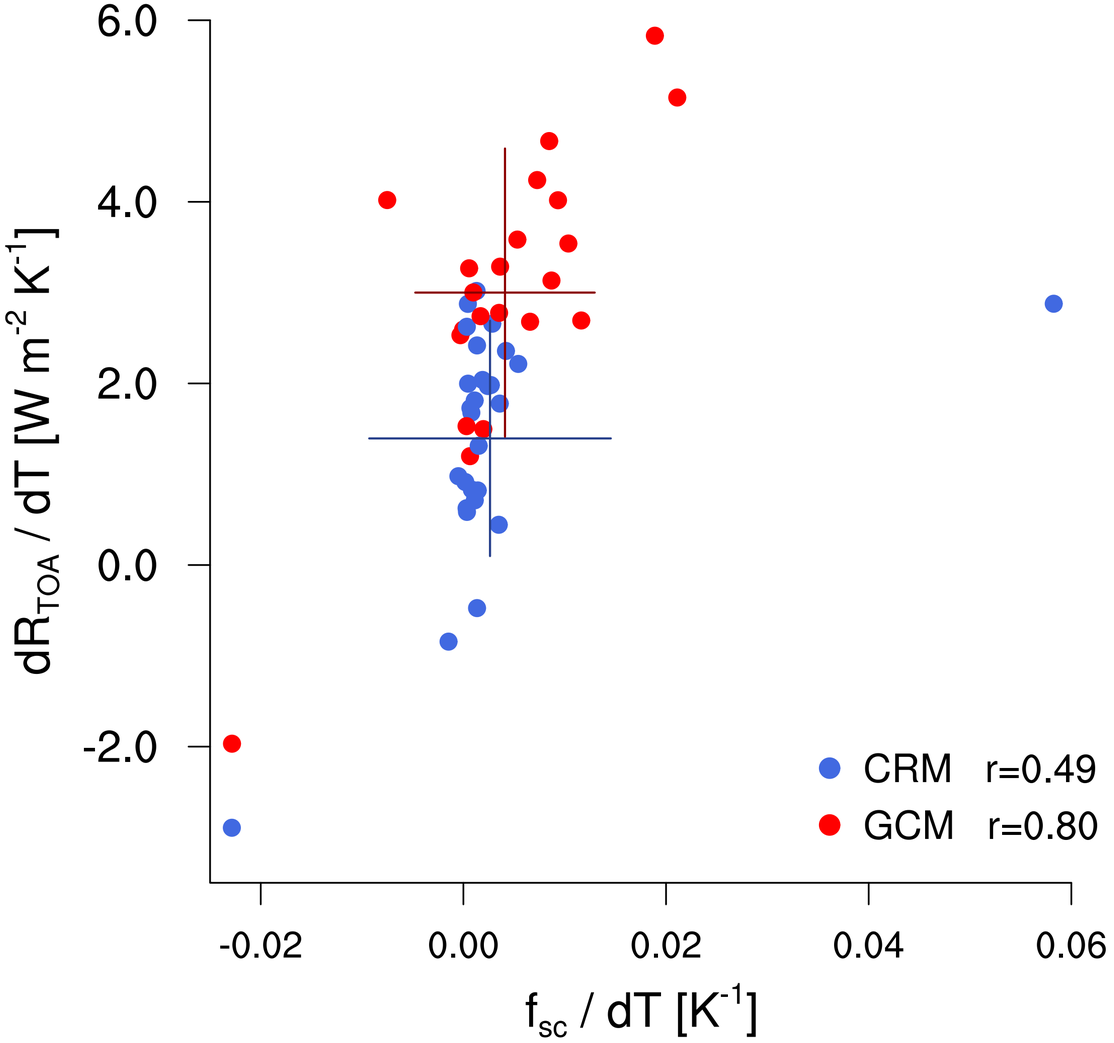

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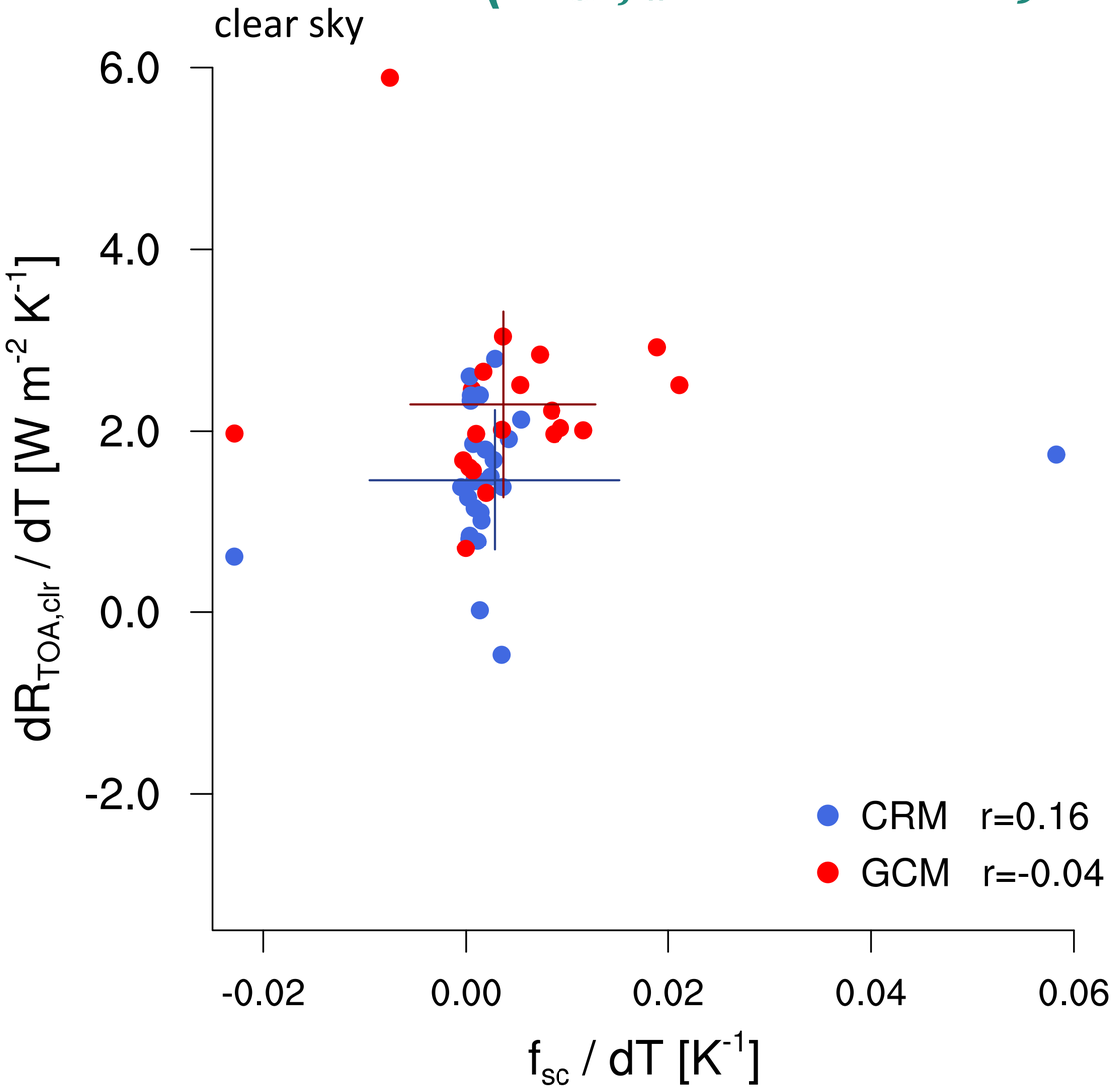

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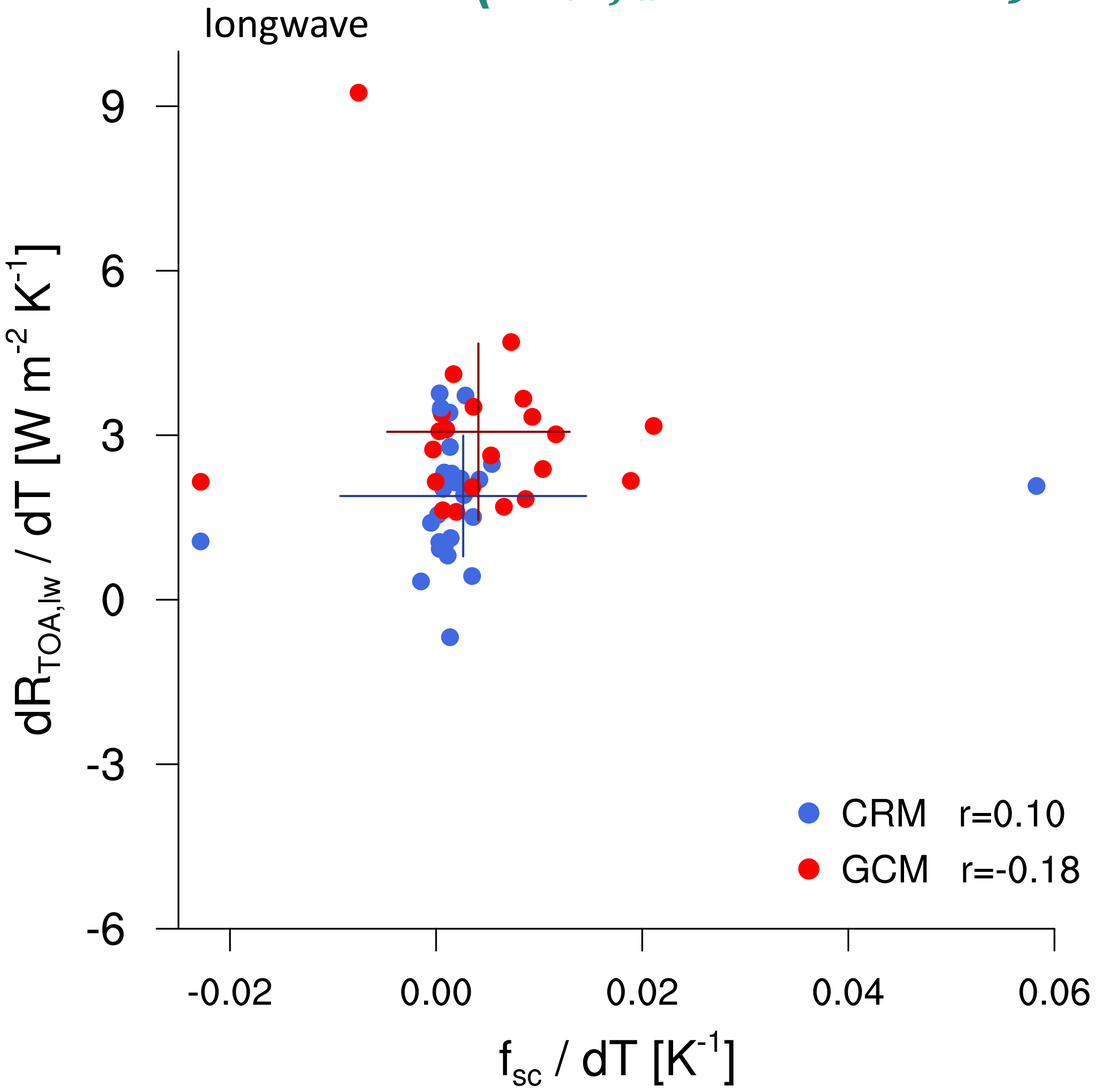

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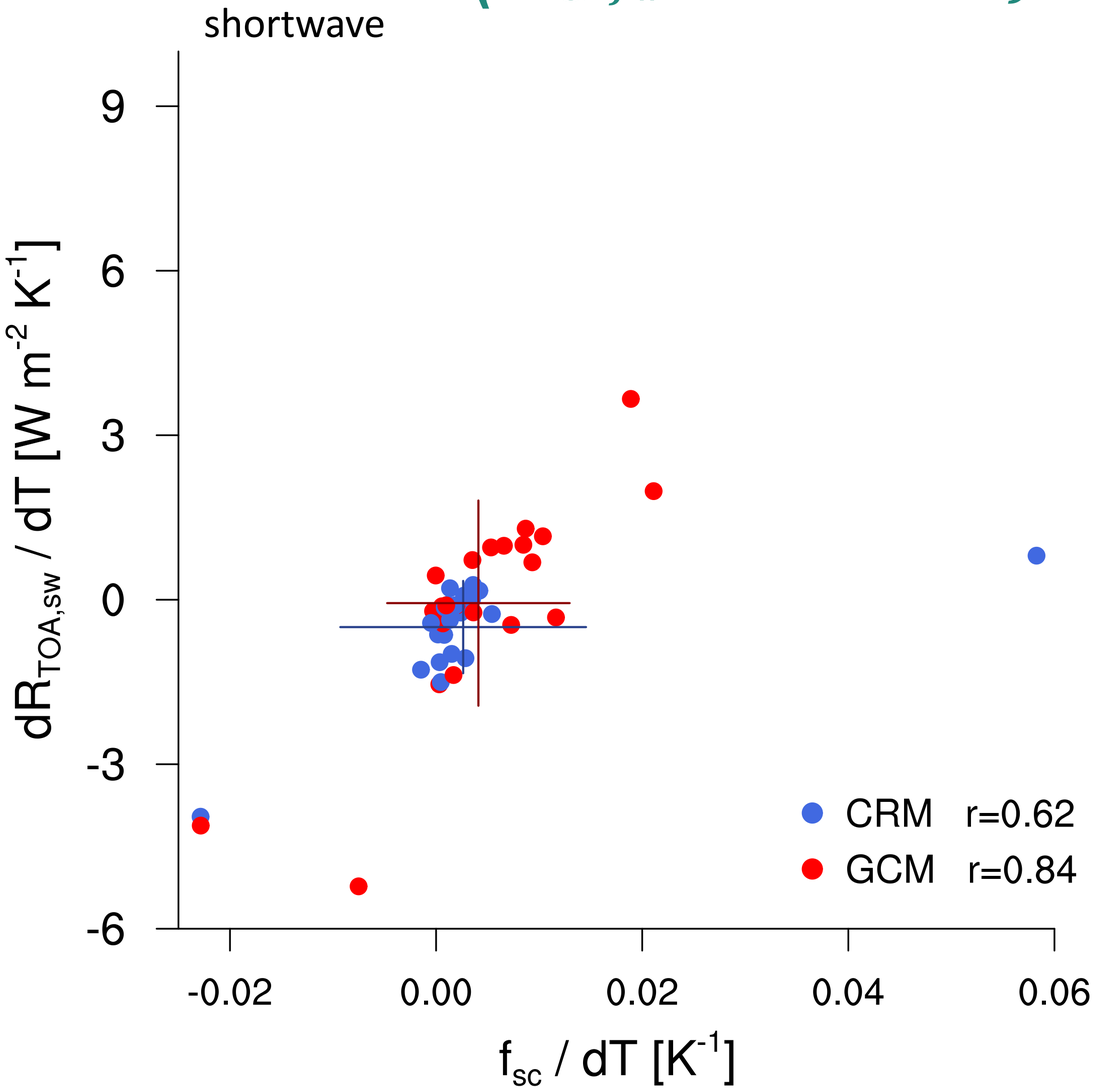

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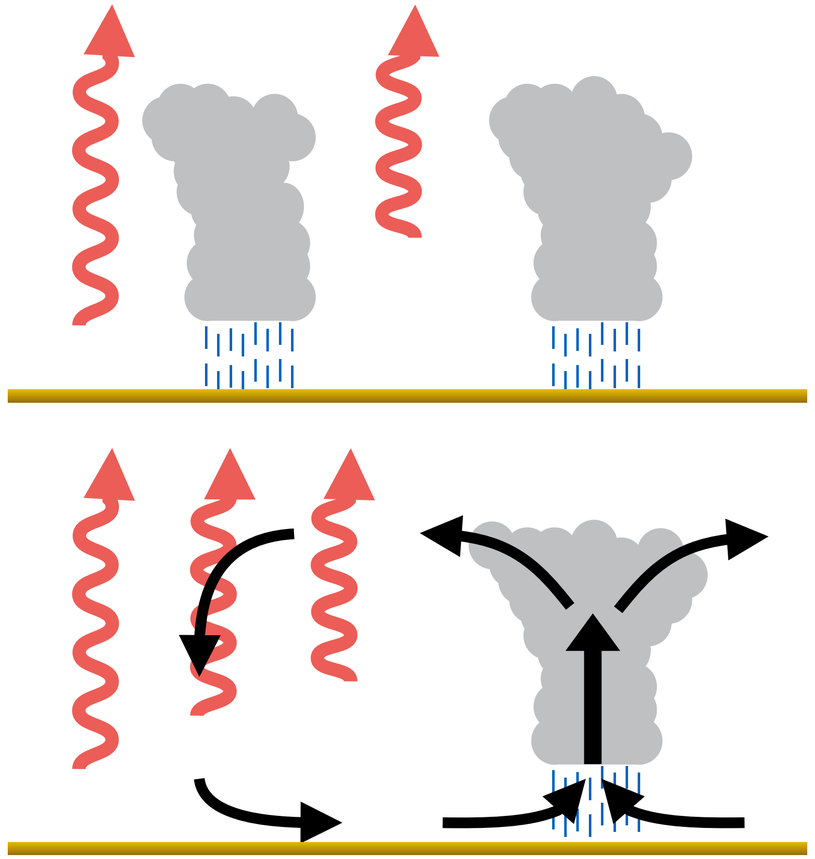

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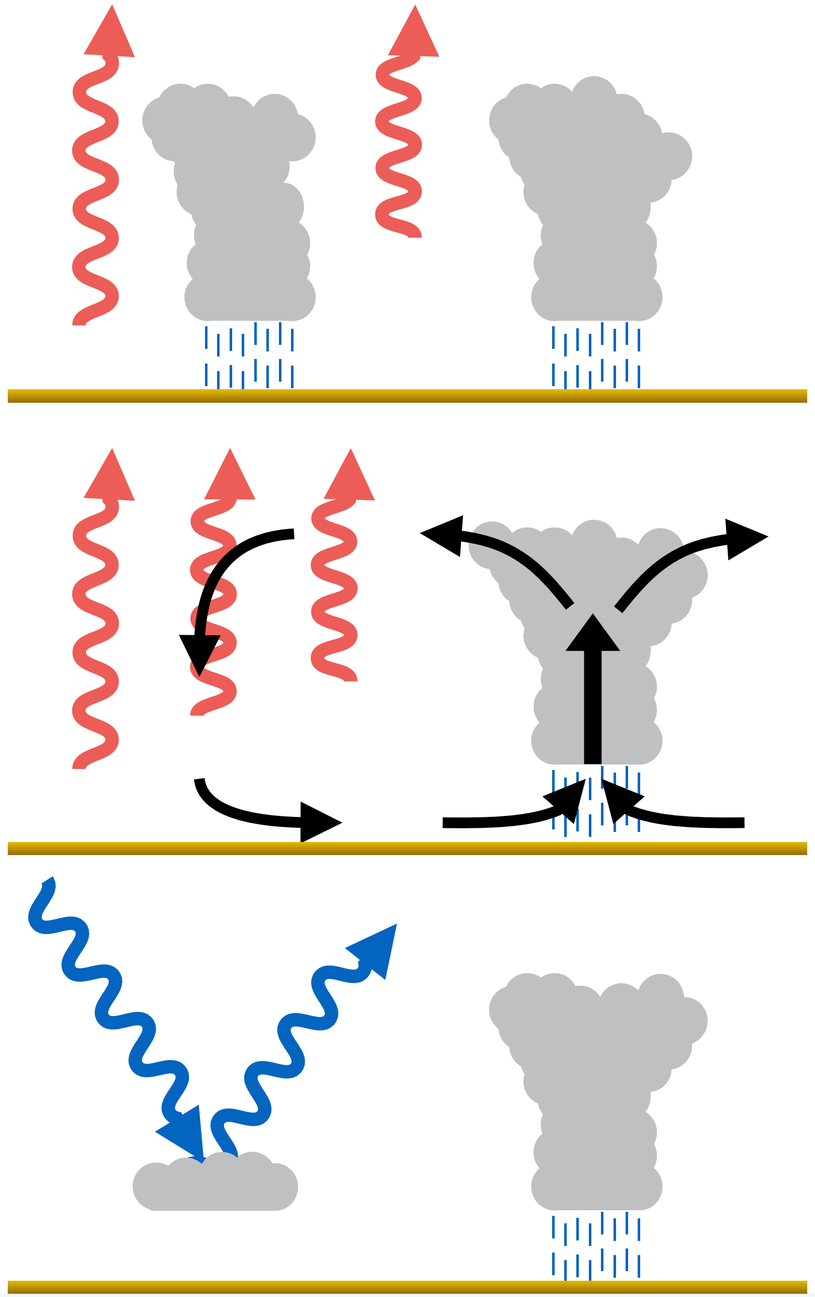

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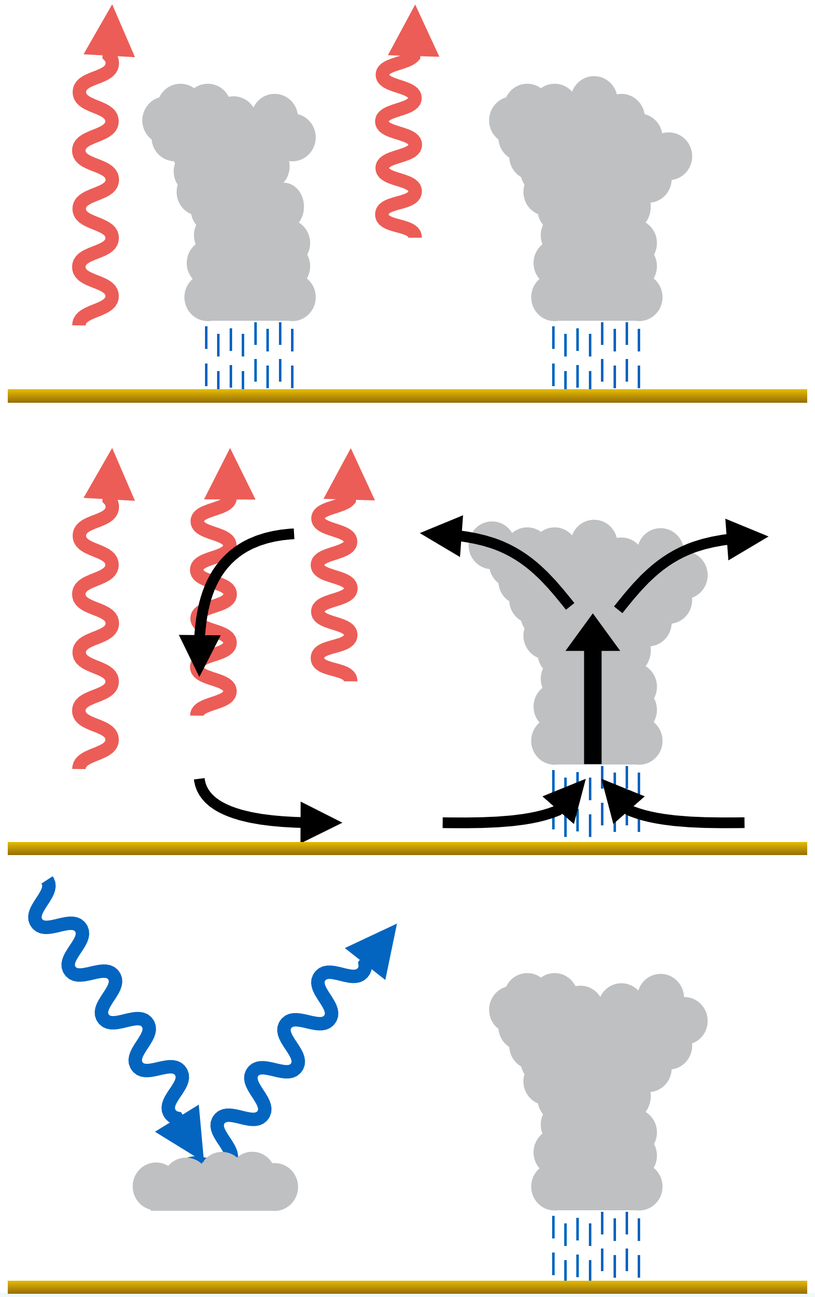

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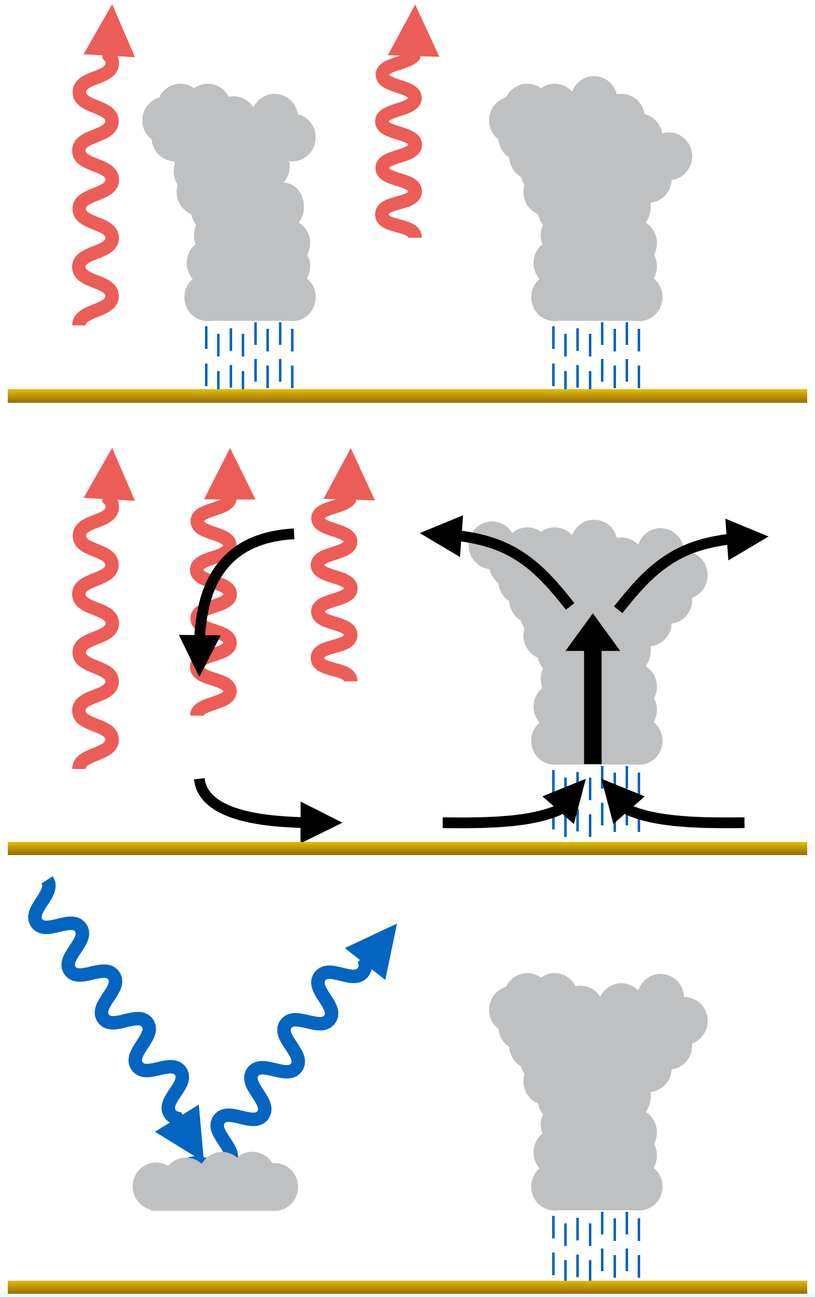

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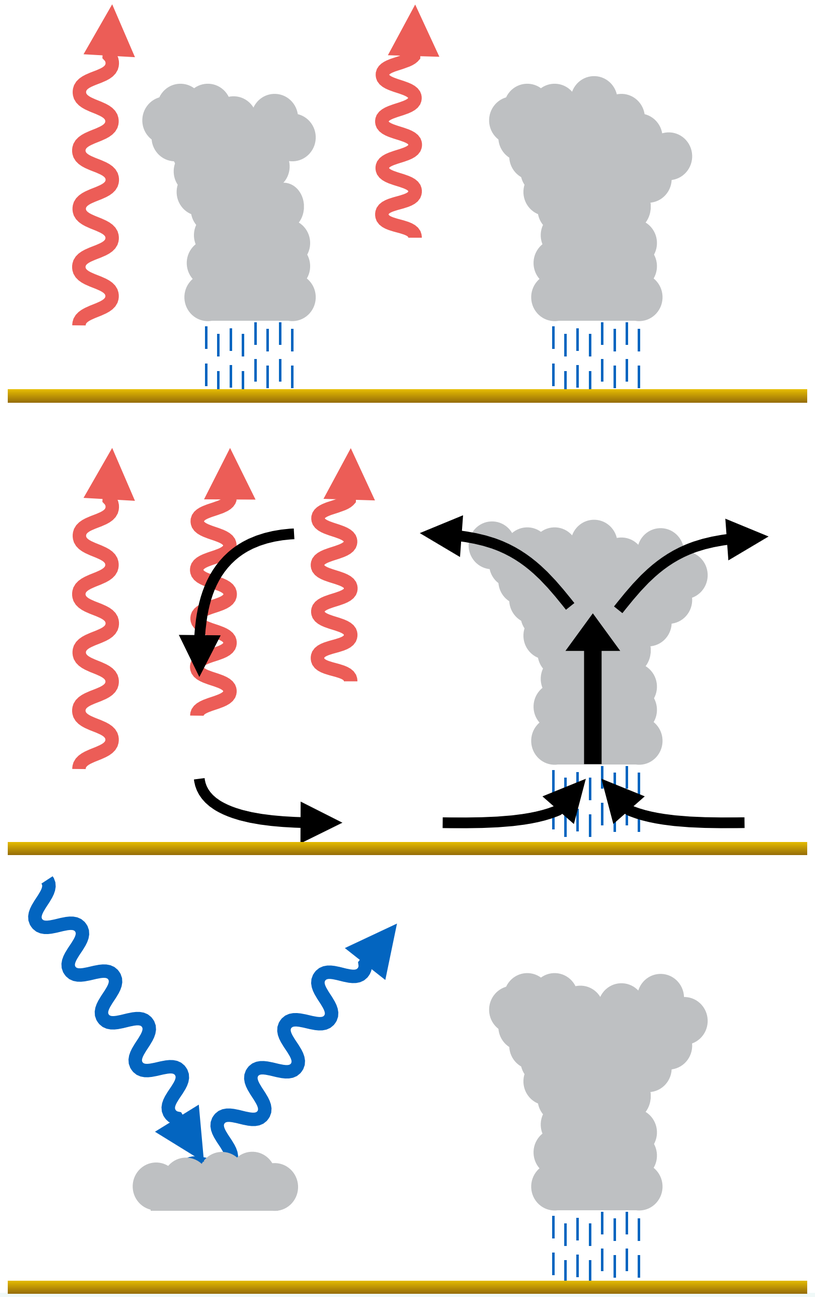

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